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CEREAL DISEASE FIELD NOTEBOOK.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY.

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U. S. Department of Agriculture

Bureau of Plant Industry,

U. S. Department of Agriculture,

CEREAL INVESTIGATIONS.
C. I. Form 11.

8-4977

Washington, D. C.



SCALE FOR ESTIMATING RUST.

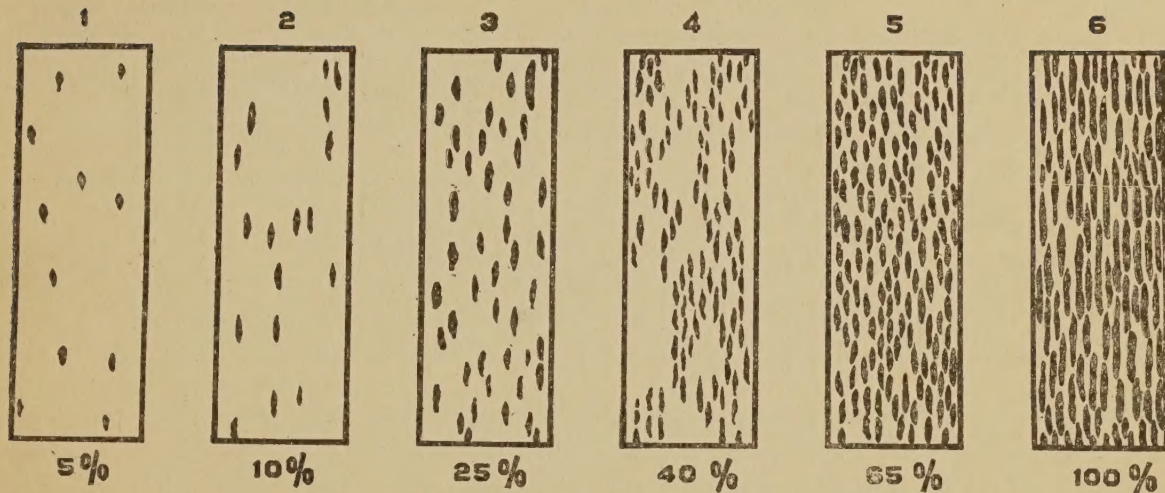


Diagram showing six degrees of rustiness, which may be used in estimating the percentage of rust infection on leaf or stem. The shaded spots represent rust, and the figures represent approximately the rust percentages, computed on the basis of the maximum amount of surface covered by rust, as shown in the 100 per cent figure. This figure (No. 6 in the diagram) represents 37 per cent of actual surface and is arbitrarily selected as 100 per cent. Other percentages are in terms of No. 6.

This scale is easy of application. A number of leaves are gathered from the row or plat at random and a number of plants carefully examined for stem rust. These are compared with the diagrams and the proper figures recorded in the notebook.

The plus or minus sign may be used to indicate a slightly greater or less amount of rust than the nearest figure.

While these figures may not accurately express the actual surface of host tissue rusted, they do provide a usable systematic method for recording rust infection and will more intelligibly represent the facts than will figures showing resistance percentages or infection percentages on the 50 per cent (maximum) basis.



HELMINTHOSPORIUM DISEASES OF BARLEY.

STRIPE DISEASE (*Helminthosporium gramineum*).

Affected plants show yellowish to straw-colored longitudinal stripes, usually in the second or third and all subsequent blades; all culms similarly attacked. The tissues in the stripes soon die, frequently resulting in the longitudinal splitting of blades. Later the stripes commonly have brown margins. At or just following heading time entire affected plants die, and following a shower or heavy dew may become dark ashy gray to almost black from abundance of spores of causal fungus. These plants soon crinkle and are more or less inconspicuous at or just before time of ripening.

Percentage estimates of this disease in the field should be made by counts of entire plants in different parts of field. Specimens should be saved wherever possible.

NET BLOTCH (*Helminthosporium teres*).

On seedling barley.—Disease evident on first leaf blade, usually middle or upper portion. Evident as yellow to brown discolorations, and later collapsed areas with more or less evident characteristic brown "netting." Scattered plants in field show this primary infection. Percentage estimates at this stage should be by counts in representative areas in field.

On subsequent stages of barley.—Disease is evident as brown blotches scattered irregularly over any or all of the leaf blades of all plants in a field. These brown blotches, from so-called secondary infections, vary greatly as to outline, but usually are narrowly oblong. They commonly show more or less yellowing at ends and characteristic brown "netting" in central portions, especially in early stages. Percentage estimates of these secondary infections should be made by same procedure as used for leaf rusts. It should be stated also which leaf blades form basis of estimates and relative abundance noted on others (e. g., 10 to 15 per cent on third leaf from head; top leaves 0 to 5 per cent; lower leaves 25 to 50 per cent, dead and dying). Specimens should be saved whenever possible.

SPOT BLOTCH (*Helminthosporium sativum*).

On seedling barley.—This disease is most evident on the first leaf, either on blade or sheath, as chocolate-brown discolorations followed by collapse of tissues involved (no "brown netting" as in net blotch); frequently more or less curling of affected first leaves also occurs, and not uncommonly seedlings succumb to this primary infection. Scattered plants show this primary infection; hence, percentage estimates at this stage should be made by counts of representative areas in field.

On subsequent stages of barley.—This disease is similar to the "net blotch" in producing secondary infections, but differs in that the scattered blotches are more of a "solid" brown color in centers, i. e., without the brown "netting," and at times with rather brilliant orange-yellow margins, especially at ends. The outlines of these blotches vary greatly, but tend to be more or less narrowly elliptical.

Percentage estimates and notes on secondary infections should be made in same manner as for "net blotch." Save specimens whenever possible.

DISEASES OF RICE.

Rotten-neck or blast.—Occurs throughout the ripening season and in two main forms: (1) As a leaf spot, large, elongated, brownish, with a light center and dark border fading to yellow at its outer edge, and (2) as a distinct brownish lesion in the peduncle, resulting in a weakening at that point during the ripening period, which causes the head to break over and become a total loss. Record through actual count in random spots the estimated percentage of loss in observed field.

CEREAL RUSTS.

Stem rusts.—Occurring on wheat, oats, barley, and rye. Produce linear pustules of dark brick-red urediniospores on stems and leaf sheaths while plants are green and black teliospores toward ripening time in the same pustules. This "black rust" is most commonly known and is a stage in the life history of the most injurious grain rusts.

Leaf rusts.—Occurring on wheat, barley, rye. Produce numerous small, roundish pustules of orange-red urediniospores on leaf blades while plants are green and black teliospores (usually not rupturing epidermis) toward ripening time.

Crown rust of oats.—Occurs on leaves and stems of oats in numerous, rather small oval, somewhat elongated pustules. Urediniospores orange yellow, teliospores brownish with a crown-like apex; hence the name crown rust. The "black rust" stage in this rust, as in the leaf rusts, is not conspicuous, because the teliospore pustules do not usually break the epidermis.

Stripe rust.—Characterized in uredinial stage by long lemon-yellow stripes on leaves, leaf sheaths, and glumes. The uredinia form lines on the leaf blades which often run together, reaching a length of 8 to 10 mm. The telia form long brownish or black lines.

CEREAL SMUTS.

To estimate smut in drilled field.—Select at random different parts of field and make counts of 200 heads, smutted and sound, as they occur in the drill row. Note number of smutted heads. Repeat several times and estimate percentage of diseased heads.

To estimate smut in broadcasted field.—Use as a unit 3.3 sq. ft., or $\frac{1}{300}$ acre. Make several unit counts in different parts of the field selected at random and compute smut estimates from these.

WHEAT.

Covered or stinking smut (bunt) of wheat matures at the time of ripening of sound heads. Spores develop in smut balls which are inclosed by the glumes. Crushed smut balls smell like herring brine or decaying fish. Immature smutted heads are somewhat darker green than smut-free heads.

Loose smut matures at flowering time. Entire head destroyed and spores easily disseminated.

OATS.

Covered smut.—Usually entire head smutted. Smut matures with ripening of sound heads. Smut masses or balls generally inclosed by outer glumes of floret.

Naked or loose smut.—Entire head generally destroyed, usually including outer glumes. Smut spores mature with ripening of sound heads. Spores easily disseminated.

BARLEY.

Covered smut.—Spores occur in firm masses corresponding to each spikelet and are inclosed by thin, whitish membrane; heads rarely project much above the boot; smaller than normal heads. Smutted heads mature with sound ones.

Loose smut.—Whole head destroyed. Spores mature at flowering time, when they are readily disseminated by winds.

RYE.

Stem smut.—Occurs usually on leaf sheath as grayish black streaks of spores. Easily scattered.

Loose smut.—Similar to that in wheat; occurs rarely in rye.

Straight-head or sterility.—So-called because of characteristic upright heads late in the season, when normal heads are drooping from weight of their grain. Affected plants often show in addition distorted glumes or, in extreme cases, the absence of one or both glumes from some of the spikelets. In foliage and color, affected plants are apparently normal. Estimate percentage of loss by making actual counts of diseased heads in a total of 200 heads. Repeat several times for any given field.

Green or false smut.—Easily distinguished by the large dark-green smut like masses to be found in place of one or more seeds on scattered heads and noticeable at maturity. The cause of but little loss, but should be reported wherever seen.

Black or true smut.—A typical smut occurring in grains of occasional heads and most noticeable at time of maturity. Should be reported when and wherever observed.

MISCELLANEOUS CEREAL DISEASES.

Bacterial blight of barley.—Disease attacks leaves, culms, and heads. Characterized by elongated lesions, which in early stages are watery translucent and in later stages are resinous brown, usually with evidence of dried exudate.

Bacterial blight of oats.—Disease attacks chiefly the leaves. May also attack head. Characterized by oval blotches, of various sizes, with collapsed dead centers and turgid, pale green to yellow, halo like margins. In advanced stages, leaves become dried up and brown.

Black chaff of wheat.—Disease attacks leaves, culms, and heads. Characterized by translucent, water-soaked to brown lesions on leaves and usually dark brown to black stripe like lesions on peduncle and outer glumes.

Ergot.—Occurs commonly in rye and occasionally in barley and wheat and rarely in oats. A horny, usually elongated, violet or purplish structure replaces the kernel. A single head may bear from one to several of these sclerotia.

To estimate percentage of ergot in field, select at random square-yard areas and note number of heads bearing sclerotia. Count total number of heads in each selected area and compute percentage of diseased heads.

Flax wilt.—Affected plants may, in severe infection, wilt and die suddenly. Usually the diseased plants first show some leaf discoloration, followed by wilting of leaves and stems. Roots of infected plants usually dead and of ashen-gray color.

Flax canker.—Affected plants show in some instances a dark-colored lesion on the stem at surface of soil. Usually the stem is deeply girdled at this point; and later the entire plant above ground falls and dies as a result of this girdling of the stem.

Nematode disease of wheat.—Disease produces abnormal crinkling and curling of young leaves and more or less distorted heads. Dark-brown hard galls, sometimes called "cockle," displace the kernels in the heads. These spread the glumes, somewhat like stinking smut. Attacked heads are usually shorter than normal, tend to remain green somewhat longer.

Oats blast.—Certain of the florets in a panicle fail to develop beyond the growth of two or three etiolated, stunted glumes of delicate, papery texture. Not infrequently the percentage of such florets is from 5 to 25 per cent.

Powdery mildew of various grains.—Characterized by fluffy grayish white patches of mycelium on the leaves. Later small, spherical black bodies (perithecia) are usually formed in the mycelial patches. Attacked portions of leaves at first lose their normal green color and later turn yellow.

Septoria on various grains.—On heads: Brown discoloration of glumes. On leaves: Light-brown blotches, usually with evidence of scattered pin-point, dark-colored bodies (pycnidia).

Scab.—A disease commonly affecting wheat, though occasionally found on barley and rye and rarely on oats. Confined to the head and often affecting only a portion or portions of it. Usually at its maximum development when kernel is in the dough stage.

Affected part of head pale colored and in sharp contrast to healthy parts. Whole heads are frequently killed by this disease. On affected heads may be seen salmon-pink discolorations, a characteristic of scab.

DISEASES OF CORN.

Common corn smut in some localities occurs frequently in tassels and occasionally on leaves, but it is most typical in the buds at nodes on lower part of stalk, i. e., in ear (or ears) and suckers. The lower ear buds are often smutted, but being small and covered with leaf sheathes are sometimes overlooked. Record percentage of smut-bearing stalks. If severe, give additional note on percentage of infected ears.

Corn root, stalk, and ear rots.—Disease affects the whole plant. Seedlings may be killed, resulting in poor stand in field. Seedlings and developing plants may become more or less stunted and “off color.” Diseased plants have weakened root systems and show internal blackening of bundles in lower nodes. Ear development is variously impeded from almost normal ear size to entire absence or mere nubbin production. Attacked ear shanks usually weakened so that ears hang down. Mature stalks, greatly weakened, break or blow down easily. Attacked ears may become variously rotted.

Head smut.—Found on corn in limited sections of Great Plains. More common in tassel than is other smut, but rarely involves leaves or husks when ear is infected. Both ear and tassel are usually smutted in a diseased stalk and are each typically destroyed as a whole. The large spongy outgrowths caused by common smut are here lacking, the black smut mass being firmer and drier and covered by a white membrane until mature.

Rust is not uncommon on the leaves of corn, particularly in southern sections, but is not known to be very injurious. A record of its occurrence should be made, however.

DISEASES OF SORGHUM.

(INCLUDING KAFIR, MILO, FETERITA, KAOLIANG, BROOM CORN, SORGO, SUDAN GRASS, ETC.)

Kernel smuts are of two kinds. Both affect the whole head, but destroy each kernel separately. In covered smut, the more common one, the rather enlarged smutted kernels generally remain intact. Diseased heads usually have a grayish appearance, due to color of membranes covering smut masses. In the loose kernel smut these membranes are thinner and usually break before head is mature, giving the latter a black, sooty appearance. This form sometimes spreads to branches or to stem of panicle. Both kernel smuts cause a stem to appear in the brush of broom corn.

Head smut typically affects head as a whole; is more frequent in branches than in main panicle. This same disease affects corn, but is more common on sorghums. The plant is affected in most, if not all, of its stalks; the heads usually sterile, if not smutted. Saccharine varieties are more susceptible, while milo is immune from this and the kernel smuts.

Red-spot or blotch (“blight”).—Occurs on the leaves and stems of all sorghums, but more particularly on Sudan grass, broom corn, and the sorgos. Its occurrence may be recorded by a general note or by figures similar to those used for the rusts.

*Numerals to be used in estimating severity of infection by any one of the
miscellaneous diseases.*

0=absence of infection.

1=very slight—one or two specimens per acre.

2=slight—8 to 10 specimens per acre.

3=considerable—30 to 40 specimens per acre.

4=abundant—25 per cent to 50 per cent of plants diseased.

5=very abundant—more than 50 per cent of plants diseased.

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
					Method.	Formula.	Covered (%)	Loose (%)	Stem (%)	Stem (%)	Stripe (%)	Leaf (%)	
Wheat			Boot.		Copper sulphate								
Oats			Flower.		Formaldehyde								
Barley			Milk.		Wet								
Rye			Dough:		Dry								
Corn			Soft.		Hot water								
Flax			Hard.		None								
Sorghum			Mature.										

MISCELLANEOUS DISEASES.

Anthracnose.
Bacterial blight.
Barley stripe disease.
Barley net blotch.
Barley spot blotch.
Black chaff.
Corn root rot.

0=absence.
1=very slight.
2=slight.
3=considerable.
4=abundant.
5=very abundant.

Connect disease and number indicating severity.

Ergot.
Flax wilt.
Flax canker.
Nematode.
Oats blast.
Powdery mildew.
Septoria: Head, leaf.

Rotation.
General vigor:
Poor.
Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ 8-4077 Specimen No. _____

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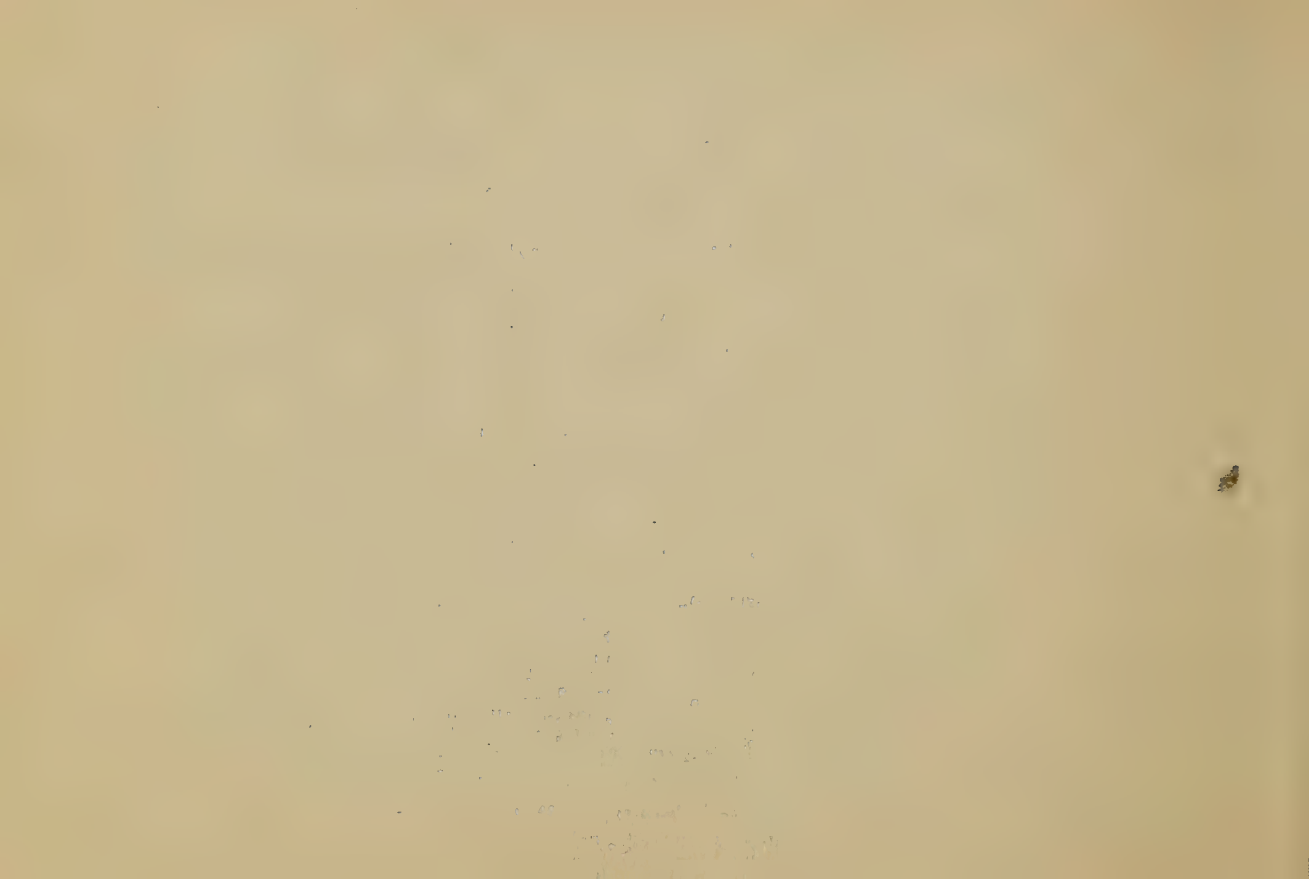
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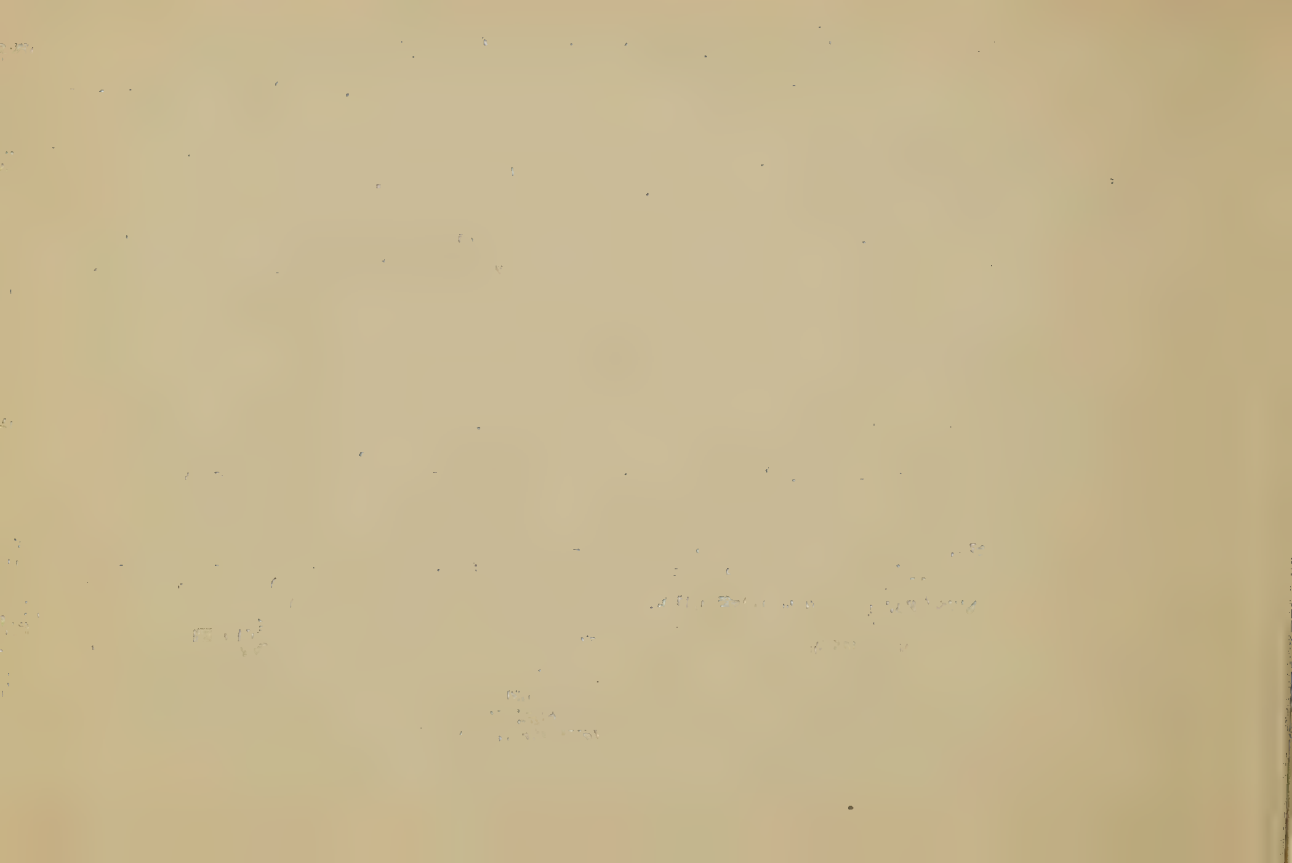
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THE UNIVERSITY OF CHICAGO

1921

11

1921

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Black chaff.
Corn root rot.

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Anthracnose.
Bacterial blight.
Barley stripe disease.
Barley net blotch.
Barley spot blotch.
Black chaff.
Corn root rot.

0=absence.
1=very slight.
2=slight.
3=considerable.
4=abundant.
5=very abundant.

Connect disease and number indicating severity.

Ergot.
Flax wilt.
Flax canker.
Nematode.
Oats blast.
Powdery mildew.
Septoria: Head, leaf.

Rotation.
General vigor:
Poor.
Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ s—4077 Specimen No. _____

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
					Method.	Formula.	Covered (%)	Loose (%)	Stem (%)	Stem (%)	Stripe (%)	Leaf (%)	
Wheat			Boot.		Copper sulphate								
Oats			Flower.		Formaldehyde								
Barley			Milk.		Wet								
Rye			Dough:		Dry								
Corn			Soft.		Hot water								
Flax			Hard.		None								
Sorghum			Mature.										

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Nematode.
Oats blast.
Powdery mildew.
Septoria: Head, leaf.

Rotation.
General vigor:
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Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ 8—4077 Specimen No. _____

1904

1904

1904

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
					Method.	Formula.	Covered (%)	Loose (%)	Stem (%)	Stem (%)	Stripe (%)	Leaf (%)	
Wheat			Boot.		Copper sulphate								
Oats			Flower.		Formaldehyde								
Barley			Milk.		Wet								
Rye			Dough:		Dry								
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Flax			Hard.		None								
Sorghum			Mature.										

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Anthracnose.
Bacterial blight.
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Barley net blotch.
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Corn root rot.

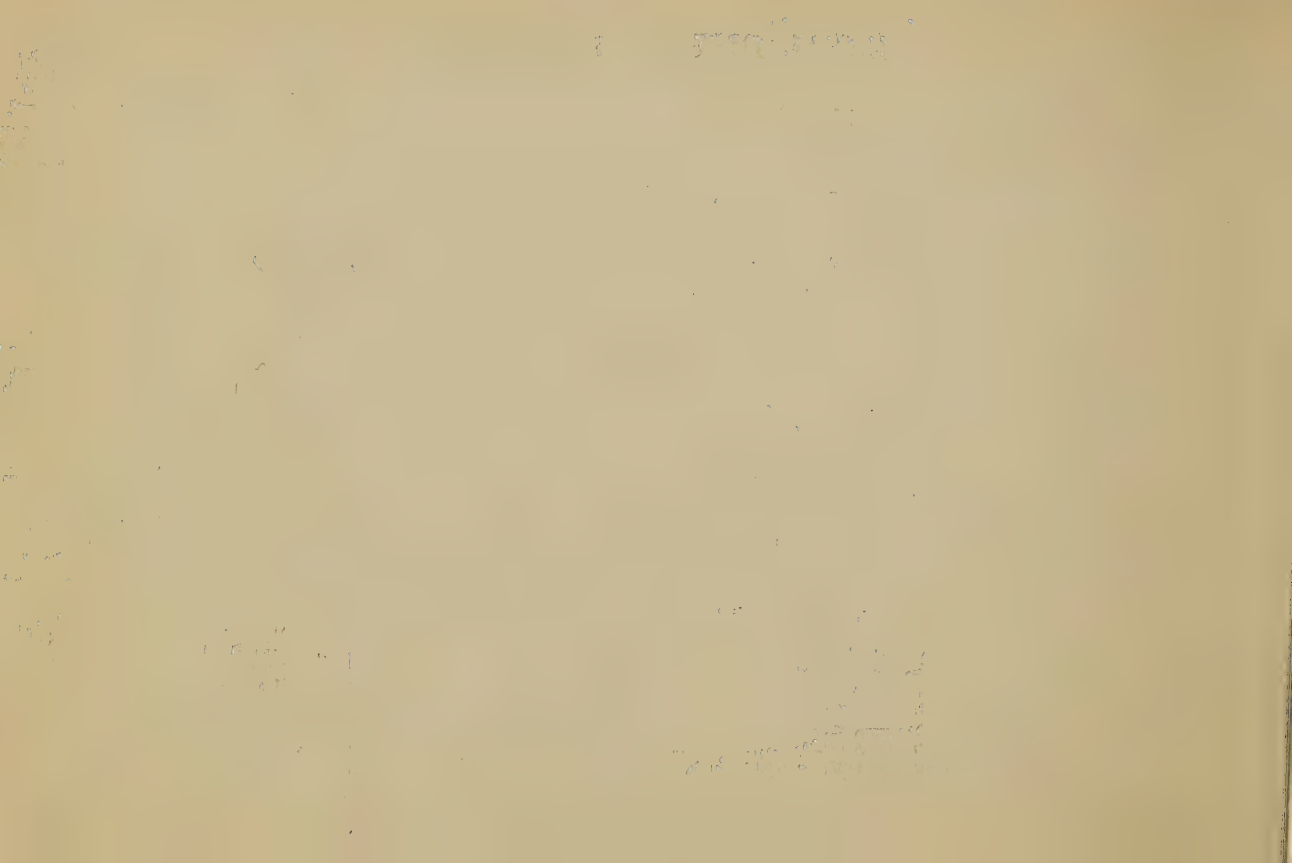
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Nematode.
Oats blast.
Powdery mildew.
Septoria: Head, leaf.

Rotation.
General vigor:
Poor.
Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ S—4077 Specimen No. _____



CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

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Septoria: Head, leaf.

Rotation.
General vigor:
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Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ 8-4077 Specimen No. _____

1892

1892

1892

1892

1892

1892

1892

1892

1892

1892

1892

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
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General vigor:
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Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ Specimen No. _____

1871

1871

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

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Dry land, irrigated, humid.

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CEREAL DISEASE ESTIMATES.

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CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____
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Rye -----	-----	-----	Dough:	-----	Dry	-----	-----	-----	-----	-----	-----	-----	-----
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Sorghum -----	-----	-----	Mature.	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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CEREAL DISEASE ESTIMATES.

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CEREAL DISEASE ESTIMATES.

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Town _____ County _____ State _____
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CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
					Method.	Formula.	Covered (%)	Loose (%)	Stem (%)	Stem (%)	Stripe (%)	Leaf (%)	
Wheat			Boot.		Copper sulphate								
Oats			Flower.		Formaldehyde								
Barley			Milk.		Wet								
Rye			Dough:		Dry								
Corn			Soft.		Hot water								
Flax			Hard.		None								
Sorghum			Mature.										

MISCELLANEOUS DISEASES.

Anthraxnose.
 Bacterial blight.
 Barley stripe disease.
 Barley net blotch.
 Barley spot blotch.
 Black chaff.
 Corn root rot.

0=absence.
 1=very slight.
 2=slight.
 3=considerable.
 4=abundant.
 5=very abundant.

Connect disease and number indicating severity.

Ergot.
 Flax wilt.
 Flax canker.
 Nematode.
 Oats blast.
 Powdery mildew.
 Septoria: Head, leaf.

Rotation.
 General vigor:
 Poor.
 Medium.
 Good.
 Excellent.
 Dry land, irrigated, humid.

Observer _____ S—4077 Specimen No. _____

CEREAL DISEASE ESTIMATES.

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Rye -----	-----	-----	Dough:	-----	Dry -----	-----	-----	-----	-----	-----	-----	-----	-----
Corn -----	-----	-----	Soft.	-----	Hot water	-----	-----	-----	-----	-----	-----	-----	-----
Flax -----	-----	-----	Hard.	-----	None -----	-----	-----	-----	-----	-----	-----	-----	-----
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Wheat			Boot.		Copper sulphate								
Oats			Flower.		Formaldehyde								
Barley			Milk.		Wet								
Rye			Dough:		Dry								
Corn			Soft.		Hot water								
Flax			Hard.		None								
Sorghum			Mature.										

MISCELLANEOUS DISEASES.

Anthracoise.
Bacterial blight.
Barley stripe disease.
Barley net blotch.
Barley spot blotch.
Black chaff.
Corn root rot.

0=absence.
1=very slight.
2=slight.
3=considerable.
4=abundant.
5=very abundant.

Connect disease and number indicating severity.

Ergot.
Flax wilt.
Flax canker.
Nematode.
Oats blast.
Powdery mildew.
Septoria: Head, leaf.

Rotation.
General vigor:
Poor.
Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer _____ Specimen No. _____

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
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CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

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CEREAL DISEASE ESTIMATES.

Town ----- County ----- State -----

Farm of ----- Date -----

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Barley -----	-----	-----	Milk.	-----	Wet -----	-----	-----	-----	-----	-----	-----	-----	-----
Rye -----	-----	-----	Dough:	-----	Dry -----	-----	-----	-----	-----	-----	-----	-----	-----
Corn -----	-----	-----	Soft.	-----	Hot water	-----	-----	-----	-----	-----	-----	-----	-----
Flax -----	-----	-----	Hard.	-----	None -----	-----	-----	-----	-----	-----	-----	-----	-----
Sorghum -----	-----	-----	Mature.	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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Septoria: Head, leaf.

Rotation.
General vigor:
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Medium.
Good.
Excellent.
Dry land, irrigated, humid.

Observer ----- S-4077 Specimen No. -----

CEREAL DISEASE ESTIMATES.

Town _____ County _____ State _____

Farm of _____ Date _____

CROP.	ACRES.	VARIETY.	STAGE OF DEVELOPMENT.	ESTIMATED YIELD.	SEED TREATMENT.		SMUT.			RUST.			FUSARIUM SCAB (%)
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